San Francisco Bay Conservation and Development Commission
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March 6, 2015

Application Summary
(For Commission consideration on March 19, 2015)

Number:	BCDC Permit Application No. 2013.004.00
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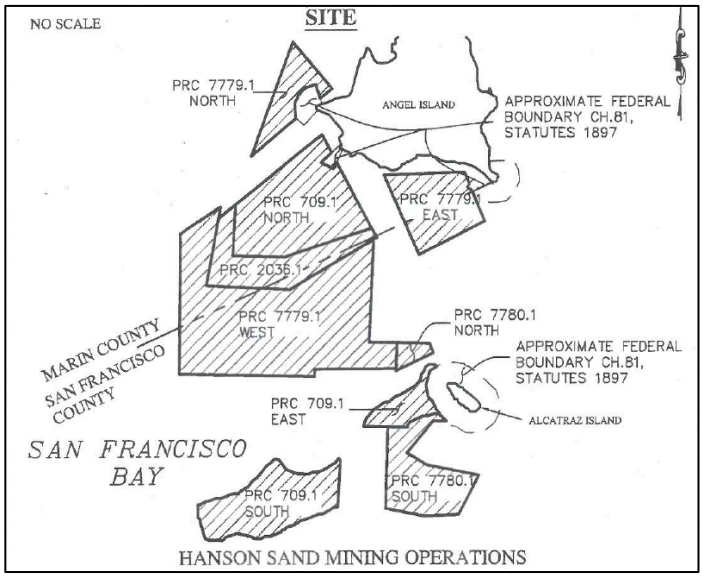
Staff Assigned:	Brenda Goeden (415/352-3623) (brenda.goeden@bcdc.ca.gov)

Summary

Applicant: Hanson Marine Operations, a subsidiary of Lehigh Hanson Inc., part of the Heidelberg Cement Group

Location: In Central San Francisco Bay, at Point Knox, Alcatraz, and Presidio Shoals, between the Golden Gate Bridge, Angel Island and the northwestern San Francisco waterfront, in the City and County of San Francisco and Marin County.



Project: The proposed project involves mining up to 1.203 million cubic yards (mcy) of construction grade sand annually for ten years from 2,601 acres of Central San Francisco Bay subtidal sand shoals (Table 1), for a total of 12,030,000 cy using a hydraulic drag arm dredge (Exhibit A and B). In addition, the project would include "peak year" mining volumes up to 1.45 mcy in any given year as long as the total does not exceed the ten year total of 12,030,000 cy over the ten year lease period. Sand would be offloaded and sold at various upland facilities throughout the Bay Area (Exhibit C).

Issues Raised: The staff believes that the application raises seven primary issues: (1) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to be designed to minimize harmful effects to tidal hydrology, sediment movement, and Bay bathymetry; (2) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to minimize impacts to fish, other aquatic organisms and wildlife; (3) whether there are feasible alternatives to dredging sand from the Bay's sandy deep water areas; (4) whether the sand mining project has been designed to minimize impacts to water quality; (5) whether the project's unavoidable adverse impacts have been adequately mitigated; (6) whether the project is consistent with the Commission's policies regarding Dredging, Navigation Safety and Oil Spill Prevention; and (7) and whether the project is consistent with the public trust.

Background

Hanson Marine Operations. Hanson Marine Operations (Hanson Marine) is a subsidiary of Lehigh Hanson, Inc. and is a part of the Heidelberg Cement Group, one of the largest building materials manufacturers in the world. With hundreds of production sites across the U.S. and Canada, Lehigh Hanson, Inc. is also one of the largest construction materials companies in North America[1]. Lehigh Hanson, Inc. manages the North American corporate functions and its subsidiaries and affiliates manufacture, supply and market cement, aggregates and other construction materials to North American customers. Hanson Marine has mined sand in the Bay

[1] www.lehighhanson.com/aboutus/company-profile.aspx

since 1999, when it purchased leaseholds from smaller sand mining companies and assumed their operations. Hanson Marine provides additional marine services, such as lightering imported sand and aggregates from British Columbia. Beginning in 2002, Hanson Marine partnered with Foss Maritime Services to operate Hanson Marine 's tug and hopper barge when mining in the San Francisco Bay.

Sand mining occurs to fill discrete construction orders for specific volumes and grain sizes. Depending on the grain size and chloride content, the sand is used to make concrete, asphalt, backfill for utility trenches and general fill. It is also used in roads, bridges, buildings and other construction purposes. Sand for these purposes can be supplied by land based quarries, imported from other countries using large, ocean going vessels, and by mining from the Bay using barges from two general locations in San Francisco Bay – Central Bay and Suisun Bay Channel.

Demand for aggregate is expected to increase as the state's population continues to grow and infrastructure is maintained, improved, and expanded. The California Geological Survey projects that the 50-year demand for all aggregate (including sand, crushed stone, and gravel) in the South San Francisco Bay and North San Francisco Bay Regions will be approximately 1,902,000,000 tons.[2] Statewide, there is a substantial shortfall in total permitted aggregate available when compared to the total demand. When compared to projections, local land-based aggregate reserves contain enough permitted resources to last through 2023 in the North Bay and through 2023 to 2032 in the South Bay. Land-based reserves also exist that currently are not permitted for mining.[3] The projections described above are for supply and demand of all forms of aggregate. Of this total, about 25 percent of total aggregates are estimated for use in high strength concrete (Portland Concrete).[4] Projections specific to sand have not been made by the California Geological Survey, and therefore it is difficult to fully understand the projection for sand use over the next fifty years.

In addition to Bay sand and local land-based reserves, the construction and transportation industries in the Bay Area also purchase aggregate from foreign producers in Mexico and British Columbia. Sand companies imported about 3.3 million tons of sand and gravel into California in 2004 and 2.4 million tons in 2005.[5] With respect to sand in particular, these companies imported into the Bay Area 1.7 million tons of British Columbia sand in 2012.[6] The Bay Area is the largest market for British Columbia (BC) sand, which is preferred for major construction projects requiring high-strength concrete due to its high quality.[7] According to the applicant, BC sand is not competitive with Bay or other locally-produced sand for private housing construction, and neighborhood infrastructure projects, road base or subbase fill, or for general fill purposes.[8]

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[2] Clinkenbeard, *Aggregate Sustainability in California*.
[3] Ibid.; John G. Parrish, *Update of Mineral Land Classification: Aggregate Materials in the North San Francisco Bay Production-Consumption Region, Sonoma, Napa, Marin, and Southwester Solano Counties, California* (California Geological Survey, 2013).
[4] Ibid.
[5] Susan Kohler, *California Non-Fuel Minerals, 2005* (California Geological Survey, 2007)
[6] Economic and Planning Systems, Inc., *Assessment of Economic Impacts Associated with Sand Mining in San Francisco Bay*.
[7] Polaris Minerals Corporation, *Management's Discussion and Analysis Year Ending December 31, 2013*, 2013; Economic and Planning Systems, Inc., *Assessment of Economic Impacts Associated with Sand Mining in San Francisco Bay*.
[8] Polaris Minerals Corporation, *Annual Information Form for the Fiscal Year Ended December 31,2012*, March 15, 2013; Economic and Planning Systems, Inc., *Assessment of Economic Impacts Associated with Sand Mining in San Francisco Bay*.

Bay Sediment Dynamics. Sediment dynamics in the Bay are complex and change over time. The Bay sediment system has been erosional during some periods and accretional in others. In addition to this natural variability, humans have greatly modified sediment dynamics in the Bay and Delta through hydraulic mining and modifications to waterways including dams and flood control measures. The Gold Rush increased sediment inputs drastically due to hydraulic mining,[9] but by 1999 this pulse of sediments had largely moved out of the Bay system. Since that time, suspended sediment flows into the Bay have since decreased markedly and are not expected to increase or return to previous levels.[10] In the early 2000's, suspended sediment concentrations in the Sacramento River were approximately half of the amount entering over the previous half-century.

Project Description

Commission Jurisdiction: The project site is in the Commission's Bay jurisdiction. The sand offloading sites are partially within the Commission's shoreline band jurisdiction, but are not the subject of this application.

Location: Hanson Marine mines sand from four lease areas, consisting of ten parcels in Central San Francisco Bay and in two Suisun Bay lease areas. This BCDC permit application involves the Central Bay lease areas only, consisting of 2,601 acres of subtidal sandy deep water shoals, at the entrance to San Francisco Bay between the Golden Gate Bridge, Angel and Alcatraz Islands. Sand mining occurs to fill discrete construction orders for specific volumes and grain sizes. The water depth within the mined area is between 20 feet Mean Lower Low Water (MLLW) and 80 feet MLLW, due to the limitations of the mining equipment.

A shipping channel runs through portions of the lease areas to the west of Alcatraz Island, but this area is naturally deep and does not require dredging for navigation purposes.

Project Details: The applicant, Hanson Marine Operations, describes the project as follows:

In the Bay: The proposed project involves mining up to 1.203 million cubic yards (mcy) of construction grade sand annually for ten years from 2,601-acres of Central San Francisco Bay subtidal sand shoals, for a total of 12,030,000 cy using a hydraulic drag arm dredge (Exhibit B). In addition, the project would include "peak year" mining volumes up to 1.45 mcy in any given year as long as the total does not exceed the ten total of 12.03 mcy. Sand would be offloaded and sold at various upland facilities throughout the Bay Area (Exhibit C).

[9] Grove, Karl, *Hydraulic-Mining Debris in the Sierra Nevada*, US Government Printing Office, 1917.
[10] David H. Schoellhamer, "Sudden Clearing of Estuarine Waters upon Crossing the Threshold from Transport Supply Regulation of Sediment Transport as an Erodible Sediment Pool Is Depleted: San Francisco Bay, 1999," *Estuaries and Coasts* 34, no. 5 (2011): 885–99.

Central Bay Leases	Annual Average Permit Volume	Peak Year Volume	Total 10-Year Total Volume
Presidio Shoals (PRC 709)	232,000 cy	290,000 cy	
Point Knox Shoal South (PRC 2036)	360,000 cy	450,000 cy	
Point Knox Shoal (PRC 7779	484,000 cy	550,000 cy	
Alcatraz South Shoal (PRC 5871)	127,000 cy	160,000 cy	
Central Bay Leases Total Volume	1,203,000	1,450,000 cy	12,030,000 cy

Mining Equipment: Hanson Marine currently owns one set of sand mining equipment, consisting of a tug and hydraulic dredge. The hydraulic dredge, the *Sand Merchant*, is 230 feet long by 55 feet wide and, when loaded, has a draft of 14 feet. Fully loaded it can carry about 2,400 cubic yards of sand. A tug is required to transport and maneuver the dredge.

The *Sand Merchant* has a hydraulic mining system made up of a 120-foot long, 24-inch diameter drag arm (trailing suction pipe), with a drag head attached to it. The drag head is 36 long by 36 inches wide with a 6-inch screen (called a "grizzly") attached to the opening that faces the substrate, which prevents material larger than 6 inches from being drawn into the drag head.

The drag arm uses a 22-inch centrifugal pump capable of pumping 15,000 gallons per minutes (gpm) through the drag head. The drag head also has an 8-inch vent pipe (1,720 gpm) that ensures the right pressure for the sand to water slurry in the suction pipe depending on the type of sand being mined. A fish screen has been installed on the vent pipe to reduce entrainment of fish through this area of the drag head.

Mining Timing and Duration: The timing and duration of a mining event depends on the equipment used, weather, tidal cycles and availability of sand at the selected mining location. Depending on the mining location and the offloading site the entire operation can last 8 to 24 hours, with the actual sand mining activities lasting 3 to 5.5 hours, occurring at any time of day. The Hanson Marine mining events carried out in the Central San Francisco Bay leases last on average 3 to 4.5 hours and yield approximately 2,400 cy of sand per event.

Mining Process: Hanson Marine uses the "moving potholing" method when mining in Central Bay. In preparation for mining, the *Sand Merchant* is positioned above the selected mining area and the drag arm is lowered into the water. Once the drag head is approximately three feet or less above the sand shoal, the pump is primed and the drag head is lowered six to 18 inches into the sand shoal. As the sand is mined, a pothole is created around the drag head. As the drag head is pushed further into the substrate, the pothole widens and sand slumps in from the sides of the depression. If there is sufficient volume of sand in one area, the drag head remains relatively stationary, adjusting as needed over the shoal. When the desired grain size of sand is depleted in that area, the barge is moved along with the drag head on Bay bottom (while pumping sand and water) until another pocket of appropriately sized sand is found. The mining continues in this way until the barge is filled.

In order to pump the sand onto the barge, it is mixed with water to create a sand slurry. Once on the barge, the slurry flows through a long chute that runs lengthwise down the barge above the hopper. The chute has hinged gates along its length each fitted with a screen to prevent larger material from being collected. The larger material excluded by the screens is discharged back into the Bay through a pipe extending from the bottom of the barge.

As the sand is loaded into the barge, the displaced water is discharged into the Bay through screened overflow pipes along with fine grain sediments and organic materials. Additionally, there is a dewatering system at the bottom of the hopper to collect water that filters through the sand. That water is also discharged into the Bay.

Processing Yards: When a mining event is complete, the *Sand Merchant* is pushed by tug to one of four current offload sites located in Central and San Pablo Bays including: the Dutra Rock Quarry yard in San Rafael; Mission Valley and Tidewater yards in San Francisco; and the Tidewater yard in Oakland. Hanson Marine has an additional yard at the waterfront in Martinez, but this yard is not currently in use (Exhibit C). From these locations, 85 percent of the mined sand is trucked to construction projects and concrete and asphalt plants located within 10 miles of the offload sites, with the remaining 15 percent of the sand trucked longer distances within the Bay Area.

Mitigation: Hanson Marine has purchased 0.017 acres at Liberty Island Conservation Bank in the Delta, a tidal habitat restoration site, to compensate for take of state listed longfin smelt and Chinook salmon and Central Valley steelhead while mining in Central Bay. In addition, the applicant is proposing to contribute $100,000 to CalRecycle's Estuary Clean Up program to aid in removal of marine debris and/or abandoned vessels, and derelict pier pilings for impacts to Essential Fish Habitat. The marine debris clean up is part of an agreement with NOAA Fisheries Service that encompasses compensation to Essential Fish Habitat for all mining activity in San Francisco Bay.

Schedule and Cost: The estimated total project cost is $25.2 million. This project would likely commence in April 2015, be ongoing and would be completed by April 2025.

Staff Analysis

The applicant is proposing to mine up to 12.03 million cubic yards of sand over ten years, with the ability to mine up to 1.45 million cubic yards from ten parcels (four leases with multiple parcels) with a hydraulic dredge as described above.

A. **Issues Raised**: The staff believes that the application raises seven primary issues: (1) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to be designed to minimize harmful effects to tidal hydrology, sediment movement, and Bay bathymetry; (2) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to minimize impacts to fish, other aquatic organisms and wildlife; (3) whether there are feasible alternatives to dredging sand from the Bay's sandy deep water areas; (4) whether the sand mining project has been designed to minimize impacts to water quality; (5) whether the project's unavoidable adverse impacts have been adequately mitigated; (6) whether the project is consistent with the Commission's policies regarding Dredging, Navigation Safety and Oil Spill Prevention; and (7) and whether the project is consistent with the public trust.

1. **Relevant Commission Policies on Sand Mining's Effects on Natural Resources.** The San Francisco Bay Plan has several policies regarding the natural resources of the Bay.

   Subtidal Areas Policy 1 states, "[a]ny proposed filling or dredging project in a subtidal area should be thoroughly evaluated to determine the local and Bay-wide effects of the project on: (a) the possible introduction or spread of invasive species; (b) tidal hydrology and sediment movement; (c) fish, other aquatic organisms and wildlife; (d) aquatic plants; and (e) the Bay's bathymetry. Projects in subtidal areas should be designed to minimize and, if feasible, avoid any harmful effects."

   Subtidal Area Policy 2 states, "[s]ubtidal areas that are scarce in the Bay or have an abundance and diversity of fish…and wildlife (…sandy deep water or underwater pinnacles) should be conserved. Filling, changes in use; and dredging projects in these areas should therefore be allowed only if: (a) there is no feasible alternative; and (b) the project provides substantial public benefits."

   Similarly, the Bay Plan policies on Fish, Other Aquatic Organisms and Wildlife policies state that "[t]o assure the benefits of fish, other aquatic organisms and wildlife for future generations, to the greatest extent feasible, the Bay's…tidal flats, and subtidal habitat should be conserved, restored and increased." The policies also state that specific habitats that are needed to conserve, increase or prevent the extinction of any native species, including special status species, should be protected.

Water Quality Policy 2 in the Bay Plan states that "[w]ater quality…should be maintained at a level that will support and promote the beneficial uses of the Bay as identified in the San Francisco Bay Regional Water Quality Control Board's *Water Quality Control Plan, San Francisco Bay Basin*…."

The Bay Plan policies on Tidal Marsh and Tidal Flats also seek to protect both habitat and wildlife. Policy 1 states, in part, that "tidal flats should be conserved to the fullest possible extent," and that "dredging projects that would substantially harm…tidal flats should be allowed only for purposes that provide substantial public benefits and only if there is no feasible alternative." Policy 2 states that "[a]ny proposed…dredging project should be thoroughly evaluated to determine the effect of the project on…tidal flats, and designed to minimize, and if feasible, avoid any harmful effects."

The Bay Plan policies on Recreation state, in part that "[s]andy beaches should be preserved, enhanced, or restored for recreational use…."

2. **Background.** Sand mining has the potential to affect two important Bay resources - the sand itself, which forms landforms and substrates (shoals and beaches), both in the Bay and in the outer California coast, and the Bay's biota, some of which use the Bay's sand as habitat.

   The following analysis regarding local and Bay-wide effects is presented in two parts: (a) physical; and (b) biological.

   a. **Physical Resources**. The Bay plan policies direct the Commission to examine potential impacts to tidal hydrology, sediment transport, tidal flats, beaches and Bay bathymetry. It is important to understand the Bay's sediment system in order to understand the potential impacts of sand mining.

      (1) **Sediment Decline.** Sand is a primary building block of the Bay and its habitats. Most sand in San Francisco Bay originates in the Sierra Nevada mountains and is transported to the bay as bedload (heavy or large sediment particles traveling on or near the bottom or bed) or in suspension with the water column, through the Delta.[11] A smaller amount of sand originates from local sources, such as Bay watersheds, coastal bluffs and cliffs, and from the Pacific Ocean via the Golden Gate. On the Bay floor, sand shoals make up large underwater dunes, some over two meters tall, particularly in Central Bay, while other shoals are made up of smaller sand "ripples" where less energy is present.

[11] Patrick L. Barnard et al., "Integration of Bed Characteristics, Geochemical Tracers, Current Measurements, and Numerical Modeling for Assessing the Provenance of Beach Sand in the San Francisco Bay Coastal System," *Marine Geology* 336 (2013)

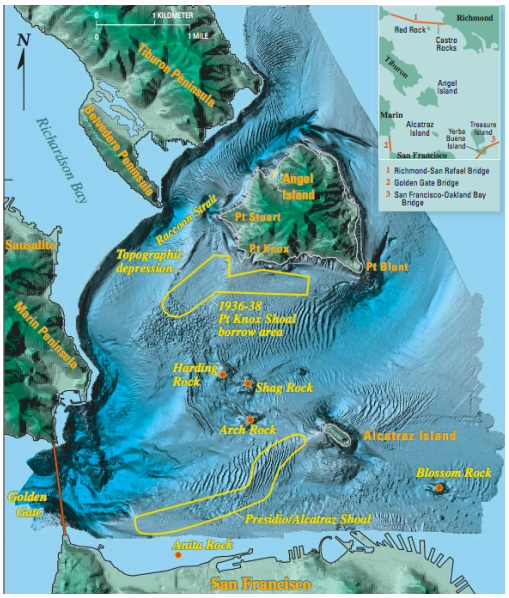

Figure 1. Multibeam survey of Central Bay with shoals delineated.[12]

System-wide, the sediment supply to the Bay, and sand supply in particular, has decreased in recent years.[13] Furthermore, due to its larger grain size, sand is readily impounded behind dams.[14] Dams and other water control structures also diminish the peak water flows required to move large amounts of sand, further decreasing the amount of sand reaching the Bay.

From 1997 to 2008, the rate of sediment loss in Central Bay was nearly three times higher than during the 1947-1979 period.[15] Most of this erosion was from sandy areas. In sediments found at the mouth of the Bay, the percentage of sand decreased while the percentage of mud increased from 1997 to 2008.[16] Finally, a recent analysis of bedforms (underwater sand dune formations) found that they are shorter than would be predicted by local water currents and hydrodynamics, indicating that the system is erosional.[17]

[12] Shifting Shoals and Shattered Rocks, Chin et al. 2004
[13] Patrick Barnard and Rikk Kvitek, "Anthropogenic Influence on Recent Bathymetric Change in West-Central San Francisco Bay," *San Francisco Estuary and Watershed Science* 8, no. 3 (2010).
[14] Matthew J. Slagel and Gary B. Griggs, "Cumulative Losses of Sand to the California Coast by Dam Impoundment," *Journal of Coastal Research*, 2008
[15] Ibid.; Theresa A. Fregoso, Amy C. Foxgrover, and Bruce E. Jaffe, *Sediment Deposition, Erosion, and Bathymetric Change in Central San Francisco Bay: 1855-1979* (U. S. Geological Survey, 2008).
[16] Patrick L. Barnard, Jeff E. Hansen, and Li H. Erikson, "Synthesis Study of an Erosion Hot Spot, Ocean Beach, California," *Journal of Coastal Research* 28, no. 4 (2012): 903–22.
[17] Patrick L. Barnard et al., "Sediment Transport Patterns in the San Francisco Bay Coastal System from Cross-Validation of Bedform Asymmetry and Modeled Residual Flux," *Marine Geology* 345 (2013): 72–95.

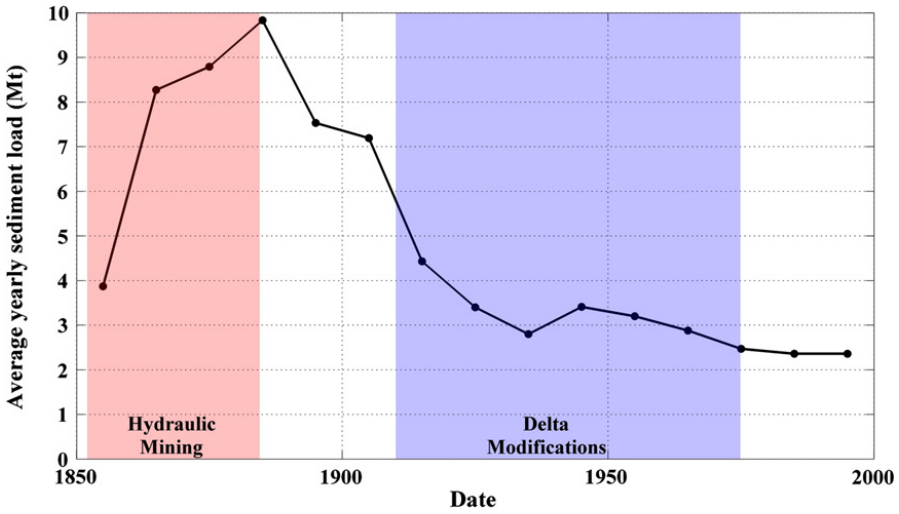

Figure 2. Reconstructed decadal sediment load from the Sacramento and San Joaquin rivers with the major periods of hydraulic mining (1852–1884) and Delta modifications (1910–1975) highlighted.[18]

With less sand in the Bay system, there is the potential for increased coastal erosion, as less sand will be supplied to beaches and underwater shoals. Smaller sand bars along the shore, and at the mouth of the Bay, are less effective at buffering the coast from wave energy. This has already been observed for the San Francisco Bar with respect to Ocean Beach.[19] However, accretion and erosion patterns for Bay beaches are not well-studied. As is the case for sediment in general, sand is increasingly being viewed as an ecological, societal, and economic resource.

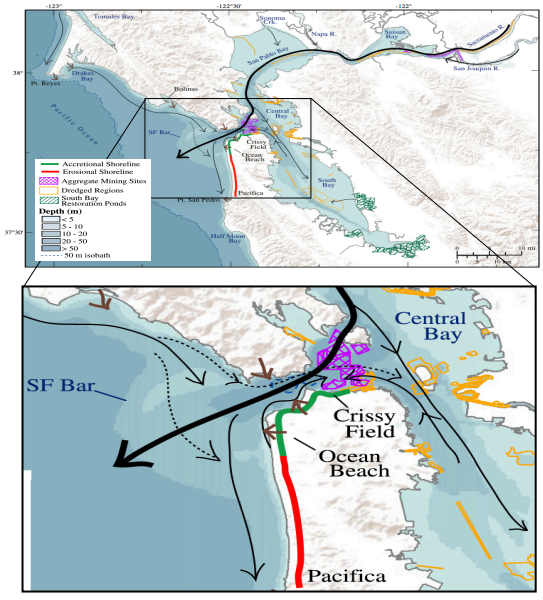

Figure 3. Model of sand transport pathways in the San Francisco Bay Coastal System. Heavier and longer arrows indicate more dominant pathways.[20]

[18] Barnard et al., "Sediment Transport in the San Francisco Bay Coastal System."
[19] Dallas and Barnard, "Anthropogenic Influences on Shoreline and Nearshore Evolution in the San Francisco Bay Coastal System."
[20] Ibid.

(2) **Sand Transport**. Within the Bay there is both sand that was deposited over geologic time (relic sand) and sand that is in transport today. While the primary sand transport pathway has been well defined for the Bay system through analysis of the mineral and biogenic/anthropogenic component of the sand,[21] the volume of sand currently entering the Bay can only be estimated, though available science is providing better information as a basis for these estimates.

In order to better understand the potential volume of sand transport in the Bay, an examination of peer-reviewed papers detailing studies of sediment inputs to the Bay was completed. A continuous long-term data set (Mallard Island 1997-present) details sediment inputs from the Delta to Bay was examined[22] and shows that on average the total suspended sediment load to the Bay is three percent sand, or approximately 19,000 cubic yards of sand per year. Additional work by the USGS, estimated the bedload contribution of sand using data from 1997-2010 from twenty-seven sites within the Delta found the average volume of sand entering the Bay as bedload to be 58,000 cy (sand makes up 86-90 percent of the total bedload).[23] Combining the volume of suspended sand and bedload, approximate 77,000 cy of sand enters the Bay from the Delta on average annually.

The other primary source for sand in the Bay is the local tributaries. The information available for these sources is extremely limited. Available empirical data from local tributaries suggests that approximately 20 percent of total suspended sediment, or 300,000 cubic yards of sand enters the Bay annually from local tributaries.[24] Bedload transport from the local tributaries is not well described. We do know that sand settles out in flood control structures and most sands are dredged prior to reaching the Bay.[25] Preliminary work has identified removal of an average of 30,000 cy of coarse grain sediment from flood control channels annually.[26] If the flood control channels were regularly maintained, sand from these channels would not enter the Bay. Further, local South Bay tributaries (mainly Calaveras Creek and Alameda Creek) deliver smaller amounts of sand that tend to remain in the South Bay.[27]

There is insufficient information available to estimate the amount of sand entering the Bay from local cliff or bluff erosion, or the outer coast, though these volumes are considered to be minor based on the sand provenance work by USGS and the local geology would suggest that these volumes are minor contributions. While important information is missing, the total annual average volume of sand being transported into the Bay from the Delta and the local

[21] Barnard et al. 2013; McGann et al. 2013.
[22] McKee et al. 2013
[23] Marineau and Wright, 2014 and Marineau USGS writ. comm. 2015.
[24] McKee et al. 2013
[25] McKee et al. in progress, 2015
[26] McKee writ. comm 2015
[27] Barnard et al., 2013

tributaries may be on the order of approximately 375,000 to 400,000 cy per year. The volume of sand that cannot be estimated is not likely to be greater than the total volume estimated from the Delta suspended sediment from local tributaries (375,000 -400,000 cy), and would likely be within the same order of magnitude on an average annual basis[28].

(3) **Relic Sand.** Relic sand was likely deposited during the last ice age (Holocene Period) when San Francisco Bay was little more than a river. Relic sand makes up the majority of deep deposits in Central Bay. This sand was likely deposited over thousands of years. A seismic refraction survey through Central Bay between Angel Island and Fort Point by the USGS identified bedrock at varying depths, and overlying sediment between 0 to 100 meters thick with the largest area being less than 30 meters thick, but there are no comprehensive surveys or data sets that show the actual depth, grain size or quality of the sediment between the sand shoals and the bedrock.[29]

Prior to purchasing the Central Bay leases in 1999, Hanson did "due diligence" level coring and took 44 samples across the lease areas to understand the resource available for mining. [30] The cores varied in length, from four to twenty-three feet long, and showed wide-ranging differences in grain sized from fine clay to gravel, both laterally and by depth across the lease areas. The cores also found both layers of sand and clay lenses, in the range of one inch to up to five feet thick. Some of the cores identified areas where the sand is mixed with five percent to 50 percent fines, which has implications for impacts to water quality due to mining. Overall, these cores depict a deep sand bed that is not homogenous, but rather has a mix of sediments, with the majority being sand of differing grain size.

While this information is helpful in understanding the aggregate available for mining, it is also helpful to better understand the sediment transport and habitat changes as sand is removed from the bottom of the Bay. Hanson Environmental used the USGS acoustic profiling information to make calculations on potential volume of sand resources above minus 90 feet MLLW, but stated "…interpretation of these results is difficult in the absence of additional information on sediment transport and replenishment within the areas where sand mining occurs." Because more specific information is not available the volume of sand resource cannot be clearly defined without a complete grain size profile of the area, but it is likely that millions of cubic yards of sand of varying quality do exist between the bedrock and the current Bay bottom.

(4) **Bay Sand Resources**. The San Francisco Bay Plan policies direct the Commission to thoroughly examine project impacts on the physical processes of the Bay. Potential project impacts include changes to sediment dynamics, including sediment transport and erosion, water currents and velocity, and salinity.

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[28] Schoellhamer and McKee, writ. comm 2015

[29] USGS 1967-68 Acoustic Profiling and 1997 USGS Bathymetry, Chin et al. 2000

[30] Keller, B. Hydrogeophysicist, 24 January 2006 Marine Permits Team Handout

In its BCDC permit application, Hanson Marine refers to the State Lands Commission Final Environmental Impact Report, 2012 (FEIR) for analysis of potential impacts to tidal hydrology. The project evaluated in the FEIR was 2.02 million cubic yards of mining activity annually for ten years in both Central and Suisun Bays. The reduced project alternative was to mine up to 1.426 million cubic yards per year for ten years for all lease areas.

To assess the potential effects on tidal hydrology, salinity and sediment transport, from the originally proposed project (mining up to 1.54 mcy annually), and the reduced project alternative (mining up to 1.14 mcy annually), the FEIR relied on a numerical model. Impacts were evaluated by comparing the existing condition with two project-condition scenarios over 15-day and one-year periods.[31] The first scenario explored the potential impacts of 10 years of mining occurring all at once over the entire lease area including areas not previously mined with a constant mining thickness. In the second scenario, mining was limited to only those portions of the lease areas that are actually mined (developed using tracking information from past mining events) assuming a constant mining thickness. The model results are intended to be used qualitatively to help evaluating the relative magnitude of change with respect to the existing condition and the proposed project."[32]

Regarding the impacts to hydrodynamics, the findings of the model indicate that the current velocity changes caused by Scenario 1 or 2 would affect areas adjacent to the lease areas as wide as the lease areas themselves (2061 acres in Central Bay), but did not provide a description of the changes. The model identified short-term increases in near-bottom salinity within the mining holes, but not outside of the lease areas.

The 15-day simulations indicated that the changes in transport patterns during both ebb and flood currents are limited to areas immediately adjacent to the lease areas. Full-year simulations indicated that the changes in net transport patterns are also limited to the leases and areas immediately adjacent to these lease areas. These model results were the same for Central and Suisun Bay lease areas. Because this modeling was qualitative, it did not describe magnitude of impacts, and therefore it is difficult to analyze the impacts to sediment transport from the project without additional information.

As explained above, the Central Bay sand shoals are largely dependent on sand transported from the Delta and local tributaries and to a lesser extent on sand coming from the outer coast.[33] According to the FEIR, approximately five percent of the sand mined from the lease areas is being replaced by natural processes.[34] Sediment transport does not appear to be keeping up with the rate of mining that has occurred in Central Bay. Coast Harbor Engineering (CHE) and the USGS[35]

[31] State Lands Commission Final Environmental Impact Report, (FEIR) pg 4.3 - 28

[32] FEIR, 2012, pg. 4.3 - 33

[33] arnard et al., 2013

[34] CHE 2009 [FEIR Appendix G]

[35] Barnard and Kivitek, 2010

independently conducted change analysis using the available multibeam surveys and came to the same conclusion, but provided a range of five to fifteen percent replenishment at the proposed rate of mining. The FEIR also found that since the proposed mining can be expected to further deepen the mining holes within the lease areas, there is the potential that these holes will attract and trap more sediment in the future.[36] While CHE suggests that since the mined areas are not being replenished at an appreciable rate, CHE found that effects on sand transport beyond the lease area are minimal. However, The modeling did not include all sand inputs into the system and important known transport mechanisms within the Central Bay. Therefore, it is difficult to determine whether this is a fully accurate description of mining effects areas outside the lease areas and the degree of the effects.

The proposed project includes mining up to 1.203 million cy of sand annually. This volume of mining would appear to appear to be approximately 800,000 cy more than all of the sand estimated to enter the system from the Delta annually, Therefore, the additional sand volume would either be relic sand or sand already in transit in the Bay system and to the coast.

(5) **Bay Beaches** The Bay Plan Recreation policies state that "[s]andy beaches should be preserved, enhanced, or restored for recreational use…consistent with wildlife protection." Historically, the west side of San Francisco had broad beach and dune systems, and the east side of Central Bay had many beaches as well[37] (Figure 4). Though the Bay shoreline has been altered, some sandy beaches still exist, including Point Pinole, Keller Beach, Crissy Field, Lands End, Candlestick Point and China Camp State Park. These beaches provide shoreline protection, habitat, and recreational opportunities. The BCDC permit application and SLC FEIR lack information regarding the potential impacts to Bay beaches, perhaps because little is known about the transport dynamics of beaches. The applicants provided information describing the East Bay beach sand as being supplied by both local cliff-derived soils and subtidal Central Bay sand.[38] With sea level rise, increasing amounts of sand will likely be needed to prevent erosion and to allow the landward migration of Bay beaches, as well as supplying the outer coast beaches that protect infrastructure and development.[39]

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[36] FEIR, 2012, pg. 4.3 -30

[37] R. Olmstead and N. Olmstead, *Ocean Beach Study: A Survey Of Historic Maps And Photographs* (City of San Francisco, California, February 23, 1979., n.d.); EcoAtlas, California Wetlands Monitoring Workgroup (CWMW), accessed June 27, 2014, http://www.ecoatlas.org.

[38] Hein, Mizell, and Barnard, "Sand Sources and Transport Pathways for the San Francisco Bay Coastal System, Based on X-Ray Diffraction Mineralogy."

[39] Barnard et al., 2013

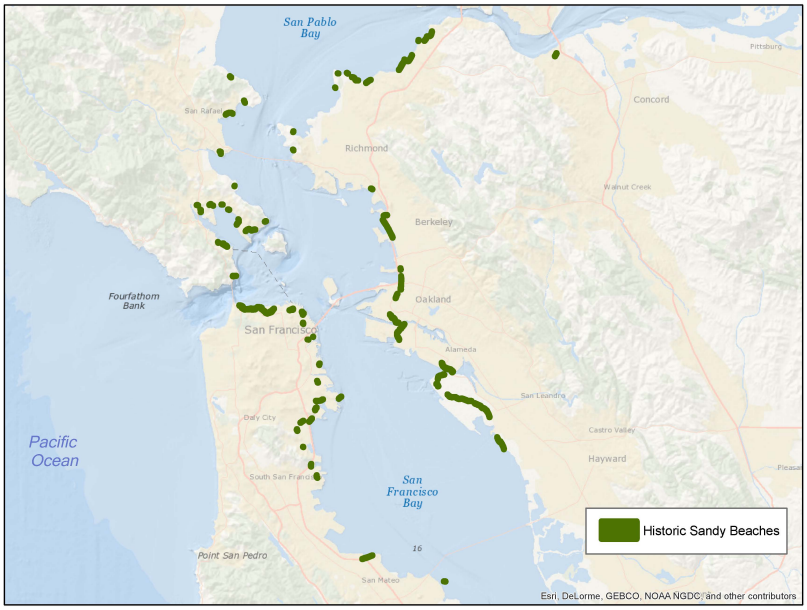

Figure 4. Historic sandy beaches inside of the Golden Gate, c. 1850.[40] Points indicate locations of beaches and do not represent the sizes of individual beaches.

(6) **Tidal Flats.** The Bay plan requires that the Commission thoroughly evaluate dredging projects to determine the effect of a project on tidal flats. Unfortunately, even less is known about how sand transport to and from these areas affects tidal flats. A review of the available research did not identify information about tidal flats beyond discussions of mudflats adjacent to marshes. There are some sandy tidal flats in the South Bay where wind surfers use the tidal flat as launching locations, but sediment content and transport is not documented.

(7) **The Outer Coast.** The McAteer Petris Act, Section 66605(d) allows the Commission to examine environmental impacts to the Bay Area. Sand transport continues from the Bay to the Outer Coast to feed beaches to the south. As currently understood, sand from the Bay is first deposited on the San Francisco Bar, a large sand bar formed by the ebb tide. From 1873 to 2005, the San Francisco Bar shrunk both in height and diameter, and migrated approximately 1 kilometer towards the shoreline.[41] This likely resulted from reduced tidal flows due to historic filling, diking, and sedimentation of the Bay, and from decreased amounts of sediment leaving the Bay as a result of hydrologic modifications upstream, mining, and dredging.[42] The erosion and contraction of the San Francisco Bar has effectively resulted in more sand being delivered to northern

[40] EcoAtlas.
[41] Kate L. Dallas and Patrick L. Barnard, "Anthropogenic Influences on Shoreline and Nearshore Evolution in the San Francisco Bay Coastal System," *Estuarine, Coastal and Shelf Science* 92, no. 1 (2011): 195–204.
[42] K. L. Dallas and P. L. Barnard, "Linking Human Impacts within an Estuary to Ebb-Tidal Delta Evolution," *Journal of Coastal Research Special*, no. 56 (2009): 713–16.

Ocean Beach, and less to southern Ocean Beach, likely exacerbating erosion to the south.[43] Additionally, modeling has demonstrated that changes to the Bar affect wave energy reaching the shoreline, with northern Ocean Beach being protected, and southern Ocean Beach being more exposed.[44] These changes help explain recent accretion at Baker Beach, Crissy Field, and northern Ocean Beach, and partially explain erosion at southern Ocean Beach.

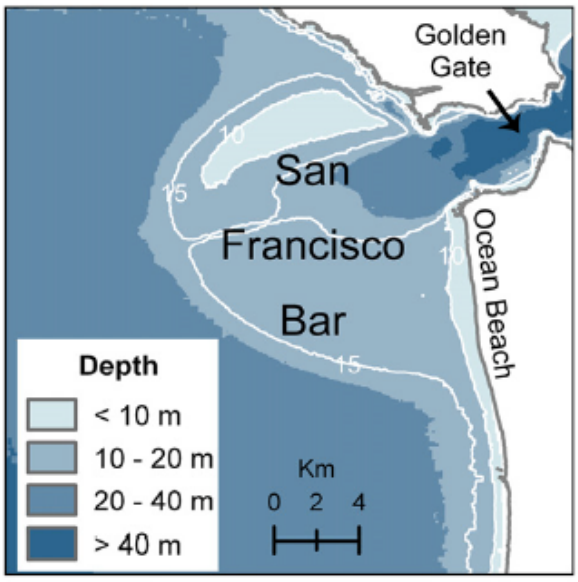

Figure 5. Location of the large underwater sand deposit known as the San Francisco Bar, or ebb-tidal delta.[45]

The California Coastal Commission, the USGS and Bay Keeper have raised concerns over the potential for sand mining to contribute to reduction in the Bar, as well as related impacts to Ocean Beach. Though there are many large and small scale factors affecting sand supply and transport in the Bay system, removing sand from sandy shoals, particularly those along the northwest San Francisco waterfront such as Presidio Shoals that have a net transport to the outer coast, could potentially affect sand supply to the Bar and outer coast beaches.[46] The FEIR found that the proposed mining in Central Bay would likely contribute 0.2 to 0.3 percent of the annual observed erosion of the Bar.[47]

[43] Jeff E. Hansen, Edwin Elias, and Patrick L. Barnard, "Changes in Surfzone Morphodynamics Driven by Multi-Decadal Contraction of a Large Ebb-Tidal Delta," *Marine Geology* 345 (2013): 221–34.
[44] Dallas and Barnard, 2011
[45] Ibid.
[46] Patrick L. Barnard et al., "Integration of Bed Characteristics, Geochemical Tracers, Current Measurements, and Numerical Modeling for Assessing the Provenance of Beach Sand in the San Francisco Bay Coastal System,"; Patrick L. Barnard et al., "Sediment Transport Patterns in the San Francisco Bay Coastal System from Cross-Validation of Bedform Asymmetry and Modeled Residual Flux."
[47] Scott Fenical et al., *Technical Report: Analysis of Impacts of Sand Mining in the San Francisco Bay on Sediment Transport and Coastal Geomorphology in San Francisco Bay, Suisun Bay, and Outside the Golden Gate*, 2013.

However, it further stated, "[i]f the overall reduction in sediment supply in the Bay-Delta system is the cause, or a contributing cause, of the erosion of the San Francisco Bar, it would be reasonable to conclude that the [sand mining] Project could make a considerable contribution to this process."

In letters to BCDC, the San Francisco Bay Keeper and the California Coastal Commission expressed concern over the ability of the model to analyze potential impacts of the project due to the limited nature of its application. The public comments call into question the model's prediction that the Central Bay shoals likely contribute only 0.2 to 0.3 percent of the annual observed erosion of the Bar. CHE suggests as a final statement in the FEIR that further research and study is needed in this area to reach more certain conclusions regarding this pathway. The public comments also request that the Commission limit the mining in Central Bay to the existing levels (400,000 cy per year) until potential impacts from the project to the Bar and Ocean Beach can be further analyzed. Tracer studies are suggested as a possible way to determine the pathway from the leases to the Bar and Ocean Beach.

(8) **Bay Bathymetry.** Mining removes sand from the Bay bottom altering its bathymetry as shown in multibeam surveys first completed in 1997 and most recently in 2013. Similarly to the discussion on sediment transport, the applicant relied primarily on the FEIR analysis for the potential impacts to Bay bathymetry. CHE completed a change analysis using available bathymetric data composed of single beam surveys completed every six months beginning in 1996 and two high-resolution multibeam surveys for Central Bay.[48] In a separate study, USGS did a change analysis for Central Bay using the same multibeam surveys. The findings for both included that Central Bay is erosional, and that the net loss of sand was five times greater within mining lease boundaries compared to non-lease areas[49]. During this time, 13.5 million cubic yards of sand were mined from Central Bay; within mining lease boundaries, approximately five percent of this was replaced by natural processes.[50] The period of the highest mining also corresponded to a period of notable bathymetric change and erosion in the mining areas within the leases[51].

The FEIR found that: (1) the reported mining volumes are approximately equal to the measured erosion from 1997 to 2008; (2) net bottom erosion due to sand mining has largely been contained within the lease and immediately adjacent areas; (3) it appears that sand mining in Central Bay is not likely to cause measurable sediment depletion in areas outside the mining areas within the proposed ten year mining period; (4) the project can be expected to further deepen the mining holes, and there is the potential that these holes will attract

[48] FEIR pg 4.3-28
[49] Barnard and Kvitek, 2010
[50] Fenical et al., 2009.
[51] Barnard and Kvitek. 2010.

and trap more sediment in the future; and (5) analysis should be performed prior to subsequent issuance of leases for mining these areas.[52] CHE further states, "mining of a non-renewable mineral resource can generally be expected to eventually deplete the resource."[53]

After the FEIR was completed, an additional multibeam change analysis was completed by the USGS as a result of a BCDC permit condition. Between 2008 and early 2014, the opposite trend was observed: Central Bay gained more sand that it lost. Mining volumes during this period were 2.2 million cubic yards, which is significantly less than the 13.5 million cy mined between 1997 and 2008. Due to noise in the data, it is not possible to directly estimate the volume of sand that replenished naturally. However, we can compare lease areas to non-lease areas; accumulation was 79 percent faster outside of mining leases compared to inside lease boundaries.[54] It is unknown why the overall patterns of sand gain and loss were different between these two time periods.

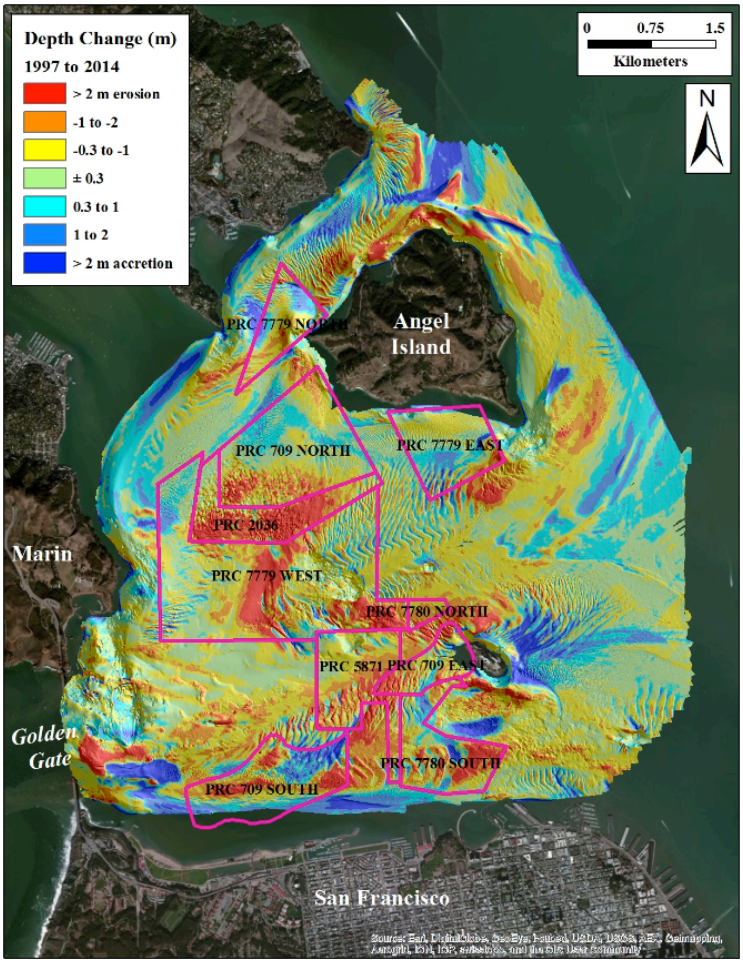

Figure 6. Changes in Central Bay bathymetry from 1997 to 2014. Pink lines indicate sand mining lease boundaries.[55]

[52] FEIR pg 4.3 -29/30
[53] FEIR pg 4.2-10
[54] Patrick Barnard, *Draft Report: Bathymetric Change Analysis for West-Central and Suisun Bay, 2008-2014* (U. S. Geological Survey, 2014).
[55] Barnard, 2014.

The applicant proposes to mine up to 1.203 million cubic yards annually for the next ten years. This level of mining is roughly equivalent to that which occurred between 1997 and 2008 where the multibeam surveys first detected the erosional areas within the leases, and thus could be expected to have similar affects over the next ten year period. Therefore, it is reasonable to assume that if sand mining occurs as proposed, more areas may deepen by over two meters or, if the mining occurs in the same area, an additional two meters, creating depressions as deep as 4 meters (approximately 12 feet), depending on how the mining is conducted. Under such a scenario, sand would be expected to slump in from the sides of the depressions or sediment from nearby areas may be transported to fill the holes, potentially deepening a larger area than is initially mined.

(9) **Bed Forms.** Bay bathymetry is not limited to depth of sediment alone. It also speaks to geomorphology, or shape of the Bay bottom and how it relates both to sediment movement and habitat features. Sand shoals can be flat, rippled or waves and can be described as underwater sand dunes that have both crests and troughs. The shape is specific both to grain size and the hydrology that creates them. Larger features are found in higher energy areas, where calmer waters produce flatter, less distinct shoals. Sand mining activity changes the wave form and the grain size of the mined area.[56] Recent studies have shown that sand crests are shorter and flatter, and the grain size is smaller than would be predicted in this area given the existing tidal hydrology.[57] What this means to the overall sediment transport and tidal hydrology of the area is unknown at this time.

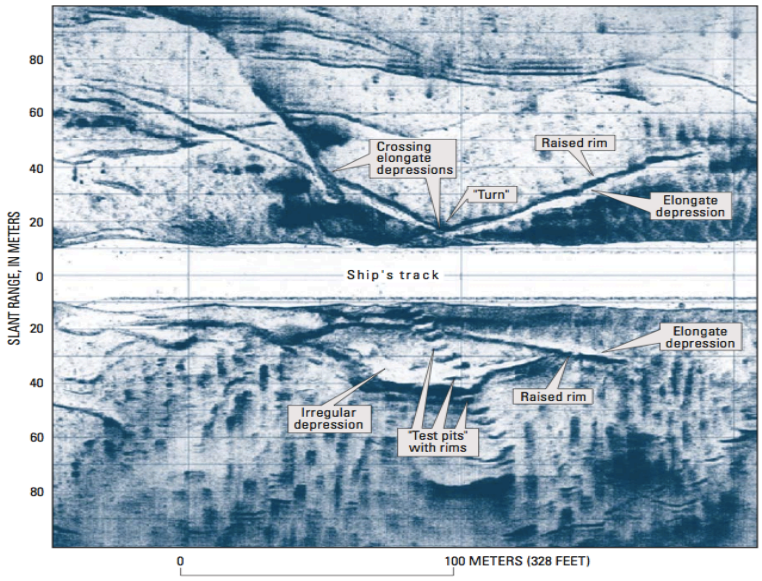

Figure 7. Multibeam images from sand mining activity on Presidio Shoal captured by USGS immediate after a mining event.58

[56] SLR EIR

[57] Barnard, 2014

[58] Chin et al. 2004 Shifting Shoals and Shattered Rocks, Human Impacts to San Francisco Bay Floor

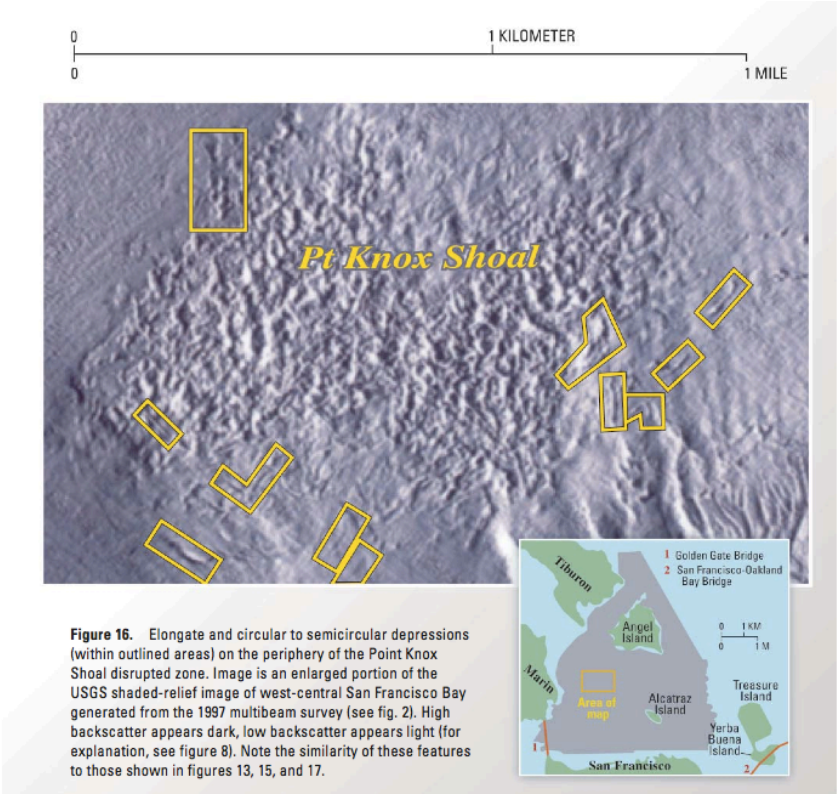

Figure 16. Elongate and circular to semicircular depressions (within outlined areas) on the periphery of the Point Knox Shoal disrupted zone. Image is an enlarged portion of the USGS shaded-relief image of west-central San Francisco Bay generated from the 1997 multibeam survey (see fig. 2). High backscatter appears dark, low backscatter appears light (for explanation, see figure 8). Note the similarity of these features to those shown in figures 13, 15, and 17.

Figure 8. Another view of mining activity on Point Knox Shoal in the area that has been most heavily mined over time. 59

The Bay Plan Subtidal Areas policies state, "projects in subtidal areas should be designed to minimize and, if feasible, avoid any harmful effects." The applicant is requesting to mine up to 1.203 cy of sand from the Central Bay, with peak mining years of 1.45 million cy, for a total of not more than 12.03 million cubic yards over a ten year period. This volume is reduced from the original request of 1.54 million cy per year for a total of 15.4 million cubic yards over ten years. This is a reduction of the overall mining request of 337,000 cy per year and 3.37 million cubic yards over ten years. In addition, the applicant has agreed to reduce mining activity further on the two lease areas that are in the direct net transport to the outer coast, potentially reducing impacts to the San Francisco Bar and Ocean Beach.

The applicant states that the EIR, its appended studies, and additional information documents the lack of harmful effects of sand mining on tidal hydrology. Additionally, the EIR concluded that continued sand mining for ten years will not result in any "measurable" or "detectable" adverse physical harm to these areas or "likely to cause measurable sediment depletion" and would not affect sediment transport outside of the immediately vicinity of the mining leases areas."

[59] Chin, et al. 2004

Other evidence and opinions suggest that: (1) Suisun, San Pablo Bay and Central Bay are currently in an erosional state; (2) the sediment supply, including sand sized sediment has shown a step decline in supply that scientists have stated is unlikely to be reversed due to human alteration of the system; (3) Central Bay is erosional and there are significant changes in the bathymetry in some lease areas; (5) Central Bay lease areas are replenishing at a rate of only five to fifteen percent of what is being mined; (6) there are changes to the bedforms themselves, which may have impacts on habitat and species that use them; (7) southern Ocean Beach is erosional, while northern Ocean Beach is accreting, likely due to the change in position of the San Francisco Bar, though these mechanisms are not well defined at this time and (8) the there is not sufficient information to quantify changes to salinity or tidal hydrology resulting from the proposed project.

The Commission should decide if the proposed project has been thoroughly analyzed for impacts to tidal hydrology, sediment transport and Bay bathymetry and if as proposed, the project has minimized harmful effects to the same.

b. **Biological Resources: Fish, Other Aquatic Organisms, and Wildlife, Subtidal Habitats and Tidal Flats.** The San Francisco Bay Plan contains policies requiring the protection of the native and threatened and endangered species of the Bay and the protection of habitat areas essential for the survival of these species. These policies include Subtidal Areas Policy One, which directs the Commission to thoroughly evaluate any proposed project in subtidal areas and minimize potential harm. Commission's Bay Plan Fish, Wildlife and Other Aquatic Organisms Policy 2 directs the Commission to conserve habitats that are important for endangered and threatened species, but also to protect habitats important for the continued existence of native species within the Bay. Policy Four requires the Commission to consult with the Resource Agencies when a proposed project has impacts to native and more specifically listed species. It also requires that the applicant obtain biological opinions and "take" permits when impacts to listed species could occur. It further directs the Commission to consider the conservation recommendations of the Resource Agencies to avoid adverse impacts to specie and wildlife habitat from a proposed project.

   The Bay Plan Subtidal Policy 2 further directs the Commission to conserve sandy deep water habitat, and allow dredging only if there is no feasible alternative and the project provides substantial public benefits. The Bay Plan policies on Fish and Wildlife and Tidal Marsh and Tidal Flats policies direct the Commission to conserve subtidal habitat and tidal flats to the fullest possible extent (specifically tidal flats). Lastly, the Region's Subtidal Habitat Goals Report has specific protection goals to "Promote no net increase in disturbance to San Francisco Bay soft bottom habitat", which includes sandy subtidal habitat and to "Promote no net loss to San Francisco Bay subtidal and intertidal sand habitats."[60]

[60] San Francisco Bay Subtidal Habitat Goals Report: Conservation planning for the submerged areas of the Bay. 2010. California Coastal Conservancy, NOAA, BCDC, and SFEP.

(1) **Central Bay Habitat.** San Francisco Bay, on average is only 6 feet deep[61] Deep water is a limited habitat within the Bay, and sand deep water is even more unique. Sand only makes up approximately eight percent of the Bay floor.[62] In Central Bay where water is deeper and currents are faster, sandy deepwater shoals are found throughout the basin west of Angel Island (Figure 1a). Some of these sandy areas are mixed with gravel and cobble, particularly near the Golden Gate, or contain pockets of mud.[63] In addition, this region is the most marine in nature of the entire Bay and serves as the entry point for species moving between the estuary and the Pacific Ocean, some using the Bay as a nursery grounds, like many species of flatfish and others as a migratory corridor, such as salmon. It also provides the physical exchange of nutrient rich upwelling events that happen off the continental shelf, which feed the Bay organisms. It is an extremely stable environment, maintaining a consistent salinity, and suspended particle matter (turbidity), which are all very similar to conditions in the outer coast, yet it more sheltered due to the surrounding topography.

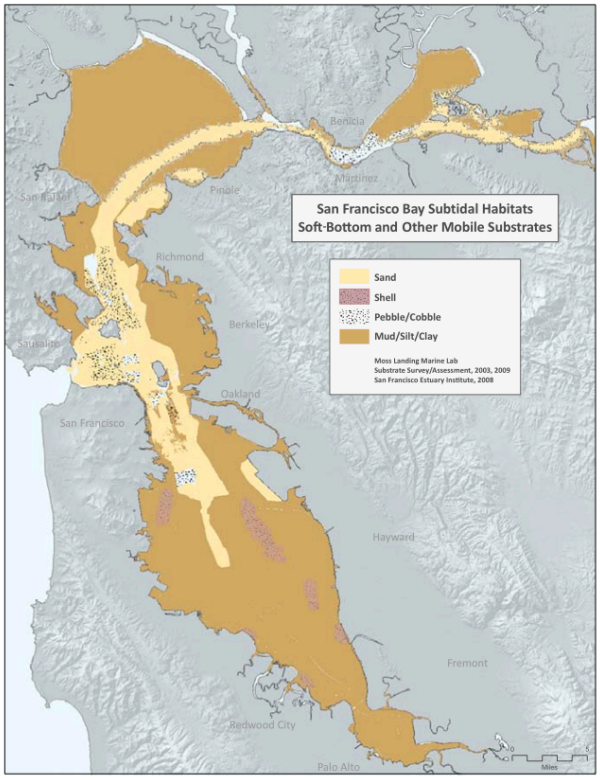

Figure 9. Distribution of soft bottom habitats in San Francisco Bay.[64]

[61] SFEI EcoAtlas

[62] BCDC, *Staff Report: San Francisco Bay Ecology and Related Habitats*, 2002

[63] FEIR

[64] Figure modified from: California State Coastal Conservancy, *San Francisco Bay Subtidal Habitat Goals Report*, 2010.

Inside the Bay, sand is deposited in deepwater sandy habitats (Figure 1a) on Bay beaches and tidal flats. Subtidally sandy habitat tends to form in deep water and along channel edges where high water velocities prevent lighter mud from settling. Similarly, beaches and tidal flats are high-energy environments where smaller particles are continually resuspended by wind-driven waves, leaving only sand sized particles along the shoreline.

This dynamic environment is habitat for a number of state and federally listed species, as well as many native species. These species within the San Francisco Estuary have many different life stages that rely to varying degrees on the estuarine system; some species of anadromous fish only use the estuary for a relatively short period of time during migration to the ocean as juveniles or back to freshwater streams for spawning, while other species live their whole lives in the estuary and rely heavily on Bay ecosystems. The NOAA National Marine Fisheries Service (NMFS) determined that the proposed project would adversely affect Essential Fish Habitat (EFH) in the San Francisco Bay. The impacts to EFH would include: (1) direct impacts and removal of the substrate (2) destabilization and slumping of shallow water habitat areas adjacent to the mining area, (3) increased depth and grain size on the lease areas[65], (4) removal of potential food prey items for species normally feeding on the benthic organisms, and (5) increased turbidity in the water column[66]. NMFS defines habitats as, "those waters or substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS considers adverse impacts to fish habitat to be those activities that "reduce quality or quantity of EFH [essential fish habitat], and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species, and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH."

Because the proposed project occurs subtidally, "habitat" in this analysis of the project's impacts on Bay species is considered both the sandy-bottom substrate of the Bay floor and also the overlying water column. The proposed project would result in the "take" of state and federally listed species as well as native Bay species.[67] Impacts to species living in the estuary as a result of the project may include: (1) impacts to open-water (pelagic) communities resulting from increased turbidity in the discharge plume created during mining activities; and (2) disturbance to bottom-dwelling species through direct entrainment or impingement of species and additional indirect impacts from habitat alteration.

(2) **Potential Impacts to Open Water Habitat.** Many fish species use deep and open water habitats on and above sandy shoals, and feed on organisms that live in and on the sand. Important fisheries species such as striped bass, Pacific herring, and Northern anchovy. Common non-fisheries species include Pacific staghorn sculpin, speckled sand dab, gobies, seven gill and leopard sharks and big skate (a type of ray).

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[65] Barnard and Kvitek, 2010

[66] NMFS Biological Opinion 2015

[67] FEIR

Listed species include green sturgeon (federally-listed as threatened), Delta smelt (federally-listed as threatened and state-listed as endangered), longfin smelt (state-listed as threatened), two populations of steelhead trout (federally-listed as threatened), and four runs of Chinook salmon (two state and federally-listed runs, and two Species of Concern under the federal Endangered Species Act).[68]

The proposed project activities would result in the creation of a discharge plume with an increased concentration of fine-grained sediment, which can persist around the project area for about 3-4 hours after completion of the mining activity until fully dissipating to background levels. Direct impacts to the open water communities resulting from increased water column turbidity may include impacts to visual foraging, susceptibility to predation and interference with migratory behavior[69], delayed hatching, and physiological impacts including clogged gills or eroded gill and epithelial tissue[70]. Indirect impacts to important open water species within the Bay may occur from a loss of benthic prey items or decreased productivity resulting from turbidity impacts to the planktonic and aquatic plant communities, which form the base of many food webs in the estuary.

Additionally the locally increased turbidity from the discharge plume may cause direct impacts to phytoplankton[71] and zooplankton, which are important food items for many species in the Bay[72]. However, the overflow plume does not last more than about 9.5 hours (depending on environmental conditions) and the impact of this local reduction in plankton productivity is likely to be minor in relation to the productivity of the entire Bay. In addition, the increased local turbidity in the discharge plume can be similar to the turbidity of large rain/runoff events in Central Bay[73].

NMFS found that the likelihood of fish exposure to the elevated turbidity levels in the overflow plume on any given day would be low since there is one full tidal cycle between mining events. Additionally the size of the overflow plume is relatively small compared to the amount of adjacent open-water areas in Central Bay.[74] The sediment-associated contaminants that may be resuspended are not expected to impact water quality to a level of concern.[75] This issue is further discussed in the Water Quality section.

Entrainment in open water occurs when an organism cannot swim or escape from the mining equipment and is sucked into the drag head or intake pipe. Some planktonic organisms, including larval stages of invertebrate and fish species, may be initially entrained during the ballasting of the hopper barge.[76]

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[68] Ibid.

[69] NMFS Biological Opinion 2015

[70] FEIR

[71] FEIR

[72] USFWS Biological Opinion. 2014

[73] NMFS Biological Opinion 2015

[74] Ibid

[75] Ibid.

[76] Applied Marine Sciences, Inc. 2009. State Lands Commission EIR, Appendix E

As part of the permitting process, the applicant obtained an Incidental Take Permit (ITP) from CDFW for potential impacts to longfin and Delta smelt, as well as salmonids for mining Bay-wide. There are no Delta smelt in Central Bay, so the US Fish and Wildlife Service (USFWS) Biological Opinion is not applicable here. In this review CDFW determined the proposed project would have impacts to state-listed salmonids and smelts and required mitigation for "take" based upon the total volume of water pumped during the mining activities and required mitigation at Liberty Island, a mitigation bank in the delta being managed for salmonids and smelt species. Additionally, NOAA Fisheries (NMFS) issued a Biological Opinion for potential impacts to salmonids, green sturgeon and Essential Fish Habitat (EFH). They identified that the proposed project would adversely impact salmonids in the San Francisco Bay, but not jeopardize the continued existence of the species, including the threatened Central Valley steelhead (*Oncorhynchus mykiss*), Central California Coast steelhead (*O. mykiss*), Central Valley Spring-run Chinook (*O. tshawytscha*), the endangered Sacramento River Winter-run Chinook (*O. tshawytscha*), and would additionally have impacts to North American Green Sturgeon (*Acipenser medirostris*).

The Resource Agencies required a number of minimization and monitoring measures to decrease the potential take of listed and native species through entrainment as a result of the proposed project. Both Resource Agencies required that the hydraulic pumps for ballasting only be turned on within three feet of the Bay floor, which reduces impacts to planktonic organisms and other species within the water column. A second important required minimization measure is the installation of fish screens on the water intake pipes to exclude the juvenile and adult life stages for many fish species located near the project area.[77] The screens are not able to prevent entrainment of eggs, larvae or plankton, only small and larger animals from being entrained. The applicant has installed these screens. NMFS is requiring the applicant to monitor and assess performance of the intake fish screens.

(3) **Potential Impacts to Benthic (Bottom) Habitat.** Sandy deep water habitat areas only account for about eight percent of the Bay floor, and are thus considered relatively "scarce in the Bay." Sand is often considered poor habitat for many bottom-dwelling organisms, but there are some species that are specifically adapted to mobile environments and can survive and thrive in these dynamic conditions. Some species such as the commercially important California halibut, English Sole and other flat fish as well as the juvenile Dungeness crab occur on the sandy bottom and utilize subtidal sand wave formations in the Bay[78] and mechanical changes to the bed formations may lead to impacts to these species[79]. Additionally the scientists

[77] North West Hydraulics Technical Memorandum regarding pump velocity 2014

[78] Subtidal Habitat Goals Report. 2010, NMFS Biological Opinion 2015

[79] Sand Mining Science Panel

participating in BCDC's Sand Mining Science Panel identified that there is little know about how fish and other organisms in the Bay utilize sandy deep-water habitats and shoals[80]. Disturbances from mining tracks on the Bay floor persist over time[81] and physically change the habitat available for various species within the Bay[82].

Bottom dwelling animals living within or on top of the sandy substrate would likely be impacted by the proposed project through direct removal of the top-layer (biologically active layer) of the benthic community, entrainment, impingement, habitat removal and fragmentation, or smothering of organisms by large debris disposed overboard during the mining operations. The direct entrainment of bottom-dwelling species may occur through the drag head or suction pipe of the mining equipment. Animals that are living within the sand, stationary or not strong swimmers (shrimp, etc.) likely cannot escape the drag head and are suck up through the pipe with the sand slurry. Larger, stronger swimming fish would likely swim away as the drag head approaches. Disturbance to benthic community organisms and benthic habitat during the proposed project may remove important prey items for groundfish species or allow for the introduction of invasive species in disturbed areas. The applicant has stated that they do not see any animals on barge, but have also confirmed that they do not examine the sand slurry for biological materials. In addition, it is unlikely that after being pumped through the system with the sand the soft-bodied animals would remain intact. As described, the mining would likely remove benthic prey items for other foragers, but this impact or the effect on the food web is not well understood.

Regarding the direct impacts to the habitat from mining, the applicant has stated that only approximately twenty-five percent of the Central Bay lease areas are impacted in any year, leaving seventy-five percent of the lease areas either in a natural state or one where recovery can occur. Further, they have stated that the benthic community (those animals living within the sand) can quickly recover either through emigration into the mined footprint or via spawning or settling of similar organisms in the water column and near by undisturbed areas. While this may be possible in areas that are minimally disturbed, the ecology of areas that are highly disturbed or large expansive of disturbance such as the Point Knox Shoal area, may have a more difficult time at recovery, or may not recover at all given the larger extent of the disturbance or the frequency in which it occurs.

The minimization measure requiring priming the pump hydraulic pumps within three feet of the Bay floor, which reduces entrainment of listed fish species, would likely not prevent the entrainment of many small, mobile and non-mobile, bottom-dwelling species living on or near the Bay floor. However, for many species, the

[80] Ibid.

[81] Barnard 2014

[82] NMFS Biological Opinion 2015

number of entrained individuals accounts for only a small portion of the total population within the Bay and would not likely cause significant reductions in the populations of these bottom-dwelling species[83]. Some bottom-dwelling fish, crabs, shrimps and other organisms may be important prey items for listed species.[84]

The estimated take "juveniles and adults of a particular species estimated to be entrained by sand mining operations range from 54 to nearly 38,000 individuals per year. For example, Bay gobies were estimated to be the most entrained species (37,901) followed by speckled sanddabs (36,739), plainfin midshipmen (27,393), English sole (22,346), Pacific staghorn sculpin (10,098), and shiner perch (5,802). These entrainment estimates represented between <0.1% and 0.6% of the estimated Central Bay regional abundance index for each species. Based on similar fish entrainment studies from hydraulic dredging activities in the Pacific Northwest, it is evident that certain species such as Pacific sand lance, which are present in San Francisco Bay, are typically entrained in large numbers…. Using entrainment data from Grays Harbor, WA, Pacific sand lance could be entrained in numbers as high as 700,000 individuals, if densities are comparable in the two locations.[85]" [there is no information on comparative densities of the Pacific sand lance in SF Bay and Grays Harbor, WA]"

Along with bottom dwelling fish, the sandy habitat is home to macro invertebrates such as crabs and shrimp. The San Francisco estuary is an important nursery ground for the Dungeness crab, which is an important commercial fishery in North Central California waters[86]. Sand mining activities in San Francisco Bay are estimated to lead to the loss of less than 0.1% of the total annual crab harvest. Entrainment of juvenile Dungeness crabs. entrainment is predicted to be much higher from Central Bay sand mining than from sand mining in the Suisun Bay. Bay-wide, an estimated 1.2 million shrimp would be entrained during sand mining activities.[87] In the Central Bay mining lease areas, the Blacktail shrimp is estimated to be the most frequently entrained species, whereas in the Middle Ground Shoal and Suisun Marsh areas, the California Bay shrimp are more heavily entrained[88]. The California Bay shrimp is a commercially important shrimp species in the Bay and sand mining activities have been estimated to entrain about 3-6% of the commercial landings. These invertebrates are important prey items for fish and other wildlife.

NMFS determined the proposed project would have impacts on Essential Fish Habitat (EFH). The proposed project's long-term impacts on habitat utilization by certain species, recruitment back into the disturbed areas, direct removal of prey items for fish, impacts to foraging behavior and recovery of the benthic community is not well understood[89]. To date, only one study has been conducted to look at the

[83] Ibid

[84] NMFS Biological Opinion 2015

[85] AMS Entrainment Study 2009

[86] Ibid.

[87] Ibid.

[88] Ibid.

[89] NMFS Biological Opinion

impacts of sand mining on benthic communities in the Bay and recovery after the mining activity. This study found no significant difference in the biological community composition between recently mined sites and those mined in the past.[90] The study conclusions were based upon a small sample size with data points collected over only a few days. Studies from other areas (other than San Francisco Bay) have looked at recovery times after a benthic disturbance and identified that recovery can take months to years and that the disturbance of the biological community and physical changes to the habitat may result in loss of ecological function for the community[91] Additionally, mining events often reoccur within the same areas of the mining leases and thus the temporary impacts from a single mining event would be considered a chronic impact[92].

NMFS required an additional study of benthic impacts because NMFS considered the study presented in the FEIR inadequate to determine potential mining effects to Essential Fish Habitat. The project proponent has agreed to form a Technical Advisory Committee (TAC), to design a benthic study that would utilize different methods to sample the benthic community in Central Bay and assess the impacts of these mining events on the benthic community recovery and organisms relying on the benthos. Once designed, the applicants would fund that study. As part of the consultation of EFH NMFS recommended that (1) an alternative source of sand be developed to minimize sand mining volumes extracted from the Bay to minimize benthic disturbance; (2) additional support or funding be contributed by the applicant to CalRecycle's efforts to remove anthropogenic debris from the Bay, which restores more natural habitat areas for fish; and (3) that the annual cumulative mining from Hanson Marine and Lind not exceed the SLC EIR baseline volume (average from 2002-2007) and that no increase in mining above this amount occur to reduce impacts to EFH.

In discussions with staff, the applicant has determined that there was the potential to reduce the proposed project volume and thereby reduce potential impacts to the Bay habitats. The originally proposal has been reduced, by 337,000 cy annually, but still includes a peak mining volume of 1.45 million cy in any year. While the overall mining is less than the maximum amount of historic mining (1.976 cy in 2000), the proposed volume is much higher than amounts of mining has occurred since 2009, when bathymetric surveys began to show some physical recovery of the mined areas.

In additional to the removal of sand, the mining activity disturbs the bedforms themselves (see Figures 7 and 8). Through repeated mining activity, the topography of the sandy deep water shoal is reduced to a surface that is pock marked and has deep depressions, irregular troughs, and reduced crests with reductions or increases in grain size within the leases, with some having coarser sediments disposed of

[90] AMS Study 2009, SLC EIR

[91] NMFS Biological Opinion

[92] Ibid.

through the overflow pipe.[93] Bottom dwelling fish, such as brown rockfish, lingcod and flatfish select specific habitat areas based upon the period between subtidal sand shoals and in the case of flatfish, can change their behavior in response to flow fields over the sand shoals. One member of the Sand Mining Science Panel speculated that changes in these subtidal sand formations could impact species having habitat associations with the shoal formations themselves, including flat fish, and that mechanical changes to the formations may lead to impacts to these species. However, there is little data on the usage of these subtidal formations by bottom dwelling fish in San Francisco Bay.

The Commission should consider whether: (1) the proposed project is consistent with the Bay Plan policies on conservation of habitat, (2) the proposed conservation recommendation are sufficient to protect critical habitat for native, state and federally listed species, (3) impacts from the proposed project have been minimized or mitigated for as much as possible, and (4) the required monitoring is sufficient to identify significant impacts to sandy subtidal habitat in and around the lease areas.

(4) **Potential Impacts to Water Quality.** The Commission's Bay Plan Water Quality policy Policy 2 states, "Water quality in all parts of the Bay should be maintained at a level that will support and promote the beneficial uses of the Bay as identified in the San Francisco Bay Regional Water Quality Control Board's Water Quality Control Plan, San Francisco Bay Basin and should be protected from all harmful or potentially harmful pollutants. The policies, recommendations, decisions, advice and authority of the State Water Resources Control Board and the Regional Board, should be the basis for carrying out the Commission's water quality responsibilities."

The proposed mining activity would result in an overflow discharge plume of fine-grained material during each mining event, which would temporarily and locally increase concentrations of suspended sediment and water turbidity.

The waters of the Bay are an important primary element[94] of the habitat for various listed and native species in the San Francisco Estuary. The salinity and turbidity of the water influences the distribution of organisms living in the estuary, as well as those transiting through portions of the Bay along their migratory routes. Different species are adapted to tolerate different salinity ranges and turbidity levels. The water (habitat) quality needs for different Bay species are also dependent upon the turbidity and the presence of contaminants in the water column.

The overflow discharge from the mining activities would create elevated turbidity levels in plume, which extends outward from the barge in the direction of tidal flow[95]. The extent and duration of the plume depends upon a number of environmental variables during the mining activity. Typically, the highest sediment concentrations are observed at the surface and at the Bay floor, where material settles[96]. The increased turbidity is present for the duration of the mining activity

[93] FEIR and Greene 2010

[94] USFWS Biological Opinion. 2014.

[95] MEC Analytical Systems Inc 1993

[96] Ibid.

and takes about an additional 3-4 hours to dissipate to background "normal" levels after the activity is completed. An overflow plume study conducted in Central Bay in 1993 measured sediment concentrations between 5-100 mg/l above the background levels in the plume. The overflow plume discharged by Hanson Marine 's Central Bay mining operations was previously measured to extend about 3,000 feet downstream of the vessel and 300 laterally from the vessel.

The short-term increased water column turbidity, may have a variety of impacts to species inhabiting the water column. For instance, the increased turbidity may be beneficial for some species during certain activities such as potentially enhancing Delta smelt feeding success. However, high turbidity levels may also lead to physiological and behavioral impacts to other Bay species. There may additionally be impacts to migration, respiration, feeding, etc. In the CEQA analysis, the State Lands Commission found that the potential impacts to species from increased turbidity of the overflow plume would be less than significant[97]. The material that would be mined mostly consists of sandy material, with a small amount of fine-grained material and that is believed to be free of contaminants due to its low carbon content. The material being mined generally contains less than ten percent fines[98], which would greatly reduce the potential concentrations of contaminants found in the sand. However, borings collected in the Central Bay lease have shown that this area contains layers of clay, which may have a high organic content, intermixed with the sandy material in the substrate.

The California Regional Water Quality Control Board, San Francisco Bay Region (Regional Board) reviewed the proposed project and determined that the proposed project is not likely to result in "water quality less than the prescribed policies"[99]. They further found determined that the currently mined shoals would have at lease a 10:1 dilution for any particular "characteristics" of concern and that the discharge would not cause a nuisance to the Bay.[100]

The Regional Board issued a Final Order for the Waste Discharge requirements on January 21, 2015, which included a Self-Monitoring and Reporting Program (SMP) and is requiring Lind to perform a study to evaluate the discharge and receiving water quality. The effluent and receiving water study would "characterize the overflow effluent toxicity and composition (suspended sediment, conventional pollutant, and toxic pollutant concentrations), the spatial and temporal extent of the overflow plume in the receiving water based on the magnitude of suspended sediment concentrations within the plume, and would compare overflow plume suspended sediment concentrations to background (ambient) conditions."[101] The study would also be designed to capture the seasonal and tidal variation in the discharge and water quality of the receiving waters. They have provisioned the

[97] FEIR

[98] FEIR

[99] SFRWQCB Final Order. 2015.

[100] Ibid.

[101] Ibid.

waste discharge requirements and water quality certification with a reopener clause that would allow the project to be reassessed if the study indicates that there are adverse impacts to water quality or beneficial uses of the receiving waters, or if new regulations or policies, are adopted during the permitted period.

Additionally, it should be noted that in Hanson Marine's operations and landside processing of sand, the sand would be rinsed with freshwater in order to remove the chlorides from the sand and make the material more suitable for use in construction grade cement.

The Commission should consider whether the project as proposed and conditioned by the Regional Board is consistent with the Commission's policies on water quality and if the potential impacts from harmful pollutants have been minimized the greatest extent. The Commission should also consider whether it would also require the Discharge and Receiving Water Study to gain further understanding of the potential impacts of the discharge plume on Bay species.

(5) **Potential Spread of Invasive Species.** The Bay Plan's Subtidal Policy One directs the Commission to evaluate the whether the proposed project would cause the spread of invasive species. San Francisco Bay is considered one of the most invaded estuaries in the nation.[102] This is largely due to the historic and current shipping industry, commercial fisheries and recreational vessels from all over the world entering the Bay. From the limited information available, Central Bay appears to have retained a community primarily composed of native species,[103] potentially due to its highly stable marine environment, lacking large changes in salinity or temperature.

There appear to be two mechanisms that could facilitate spread of invasive species though mining activity: transport of invasives by the mining equipment and through habitat disturbance from the mining activity. According to Hanson Marine, the proposed mining activity uses a single barge and tug combination that does not leave the Bay. It is used to mine sand both in Central Bay and Suisun Bay, which has a highly invaded community, including sand colonized by Asian clams, invasive zooplankton and vegetation. There is potential for invasive species to be transported by the equipment as it moves between Central Bay and Suisun or to offloading yards, but the change in salinity may make Central Bay inhospitable to these species. No issue has been identified to date from using the equipment in both locations.

The practice of mining removes both sand and species living within and on top of the sand. In disturbing the habitat in this way, areas devoid of native species within the mined footprint are available for non-natives to colonize without competition from well-established natives[104]. Due to a lack of complete information regarding this habitat and the communities that live in these areas, it is difficult to assess this potential impact, other than to note that the potential exists to provide non-natives a foothold in Central Bay sand shoals due to the mining activity.

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[102] Cohen and Carlton 1998

[103] AMS Entrainment Study, FEIR

[104] Nature of Invasive species colonization

The Commission should consider whether additional measures should be taken to either better understand the potential for spread of invasive species or to minimize the potential spread of invasive species are necessary.

(6) **Potential Impacts to Aquatic plants.** The Bay Plan's Subtidal Policy 1 directs the Commission to evaluate the impacts of the proposed project on the Bay's aquatic plants. The Bay is home to a number of aquatic plants and algae (seaweeds) native to the area, including eelgrass and seaweeds of different varieties. Both aquatic plants and algae need light to undergo photosynthesis. In addition, algae generally need a hard substrate to attach to in order to withstand tides and currents. Due to the deep-water nature, limited light penetration and shifting sands found at the mining lease area, it is assumed that there are no aquatic plants or algae living there. However, because several islands and rock outcroppings occur in Central Bay, there are a variety of algae growing on the hard surfaces of these areas[105]. Increased turbidity associated with the overflow plume could have an adverse impact on these algae if the suspended sediment were able to settle on the algae blades and prevent or limit photosynthesis activity. However, as described above, the mining activity is limited to areas deeper than minus 30 feet Mean Lower Low Water (MLLW) and a minimum of 100 feet from the islands' edge. Providing these buffer zones in combination with the swift tides and currents should minimize any settlement of fine sediments on adjacent algae beds.

The Commission should decide whether the buffer zones around the Central Bay islands are sufficient to minimize impacts and avoid potential harmful effects to aquatic plants or algae near the lease areas.

3. **Feasibility and Public Benefits**. The Commission's Subtidal Policy 2 states, "Subtidal areas that are scarce in the Bay, or have an abundance and diversity of fish, other aquatic organisms and wildlife (e.g. eelgrass beds, sandy deep water or underwater pinnacles) should be conserved. Filling, … and dredging projects in these areas should therefore be allowed only if: (a) there is no feasible alternative; and (b) the project provides substantial public benefits."

   This policy requires the Commission to evaluate the feasibility of other alternatives of obtaining sand from locations other than "sandy deep water" areas in the Bay. There are other sources of sand than sand dredged from the Bay's sandy deep water sites. Large volumes of sand are imported into the Bay Area from British Columbia. For example, approximately 1.7 mcy of sand were imported into the Bay Area in 2012. Comparatively, approximately 0.25 mcy were mined from the Central Bay that same year. Sands and aggregate from Bay area land quarries also provide sands to the Bay area market. However, obtaining sands from these sources have downsides. Such sands are typically more expensive to produce, cost more to transport, and as a result of both their production and transport, produce more greenhouse gases in getting them to demand sites than obtaining sand from the Bay's deep water sandy sites. Hanson also has stated that the ships importing sand need deep draft berthing areas

[105] Smithsonian Research here.

and that their existing barges are not designed to be top loaded, so additional barges would need to be acquired to offload imports. Transporting sand from local land-based quarries would increase wear and tear on roadways, fuel consumption and traffic congestion.

In assessing the feasibility of these alternative sources, the Commission must apply the definition of feasibility contained in the CEQA (PRC § 21061.1) and in the CEQA Guidelines (14 CCR § 15364). The definition in CEQA also includes not just physical, technological, economic or legal impossibility, but also public policy consistency. [106] An example of the use of public policy concerns as the basis for rejecting a project alternative as infeasible can be found in the FEIR for the project presently before the Commission prepared by the State Lands Commission. In the FEIR the SLC rejected as "infeasible" any reduction in the volume of sand for which the mining companies were seeking leases on the basis of the increased greenhouse gas emissions in which the transportation of sand from alternative sources would result.

In determining whether the proposed sand mining project is allowable under Subtidal Policy 2, the Commission must determine: (1) whether there are alternatives to dredging sand from the Bay's sandy deep water areas; (2) the feasibility of any such alternatives by weighing the adverse impacts associated with these alternatives (largely the production of greenhouse gases and increased cost of sand) against the adverse effects of the proposed activity on a limited Bay resource and its associated biota, as described elsewhere in this application summary; and (3) the public benefits of dredging sand from the bay.

4. **Mitigation.** The Commission's policies on Mitigation states that "[p]rojects should be designed to avoid adverse environmental impacts to Bay natural resources such as…fish, other aquatic organisms and wildlife habitat, subtidal areas…or tidal flats. Whenever adverse impacts cannot be avoided, they should be minimized to the greatest extent practicable...and mitigation for unavoidable adverse impacts to the natural resources of the Bay should be required."

   The impacts to Bay resources from the proposed mining activity would include those specific to the lease areas as well as potential impacts beyond the lease boundaries. As previously discussed in other sections of this report, the potential unavoidable impacts from this project within the lease include: (1) entrainment of special status and native species through the drag head; (2) entrainment of the eggs or larval stage of special status and native species through the screened water intake pipe; (3) temporary increases in suspended sediment loads; (4) degradation of sandy habitat by removal of prey and benthic invertebrates; and (5) degradation of habitat through bedform removal and modification of substrate, both in reduction of grain size of sand and sand wave formation.

[106] *Defend the Bay v. City of Irvine* (2004) 119 Cal.App.4th 1261

In addition, potential impacts beyond the lease boundaries include the entrainment of fish, including special status species, eggs, larvae and plankton that move in and out of the lease boundaries as part of their life cycle; temporary increases in suspended sediment concentrations while mining is occurring; and reduction in sand supply to the system, including Bay shoals, the San Francisco Bar and potentially southern Ocean Beach.

While the applicant has worked to reduce impacts to threatened and endangered species through the installation of a fish screen and reduction in mining volumes, other impacts to EFH cannot be further reduced or minimized due to the nature of the mining activity and therefore mitigation would be required.

When unavoidable impacts are identified, the Bay Plan policies on mitigation provide guidance regarding how those impacts should be mitigated. The mitigation policies state that "individual compensatory mitigation projects should be sited and designed within a Bay-wide ecological context, as close to the impact site as practicable, to compensate for the adverse impacts," ensure success and support the improved health of the Bay ecology. They further state that the Commission should consider benefits to humans from Bay natural resources; that the rationale for the mitigation should be clear; the siting of the mitigation should be in an area where adjacent land uses and connections to other habitats improve the potential for successful outcomes; and that mitigation should be provided prior to or concurrent with the proposed project.

The policies also provide that when compensatory mitigation is necessary, a mitigation program should be reviewed and approved by or on behalf of the Commission as part of the project, and describe the "[p]rovisions for the long-term maintenance, management and protection of the mitigation site, such as a conservation easement, cash endowment, and transfer of title." The mitigation programs are also expanded by the Commission's policies that state that they "…should be coordinated with all affected local, state, and federal agencies having jurisdiction or mitigation expertise to ensure, to the maximum practicable extent, a single mitigation program that satisfies the policies of all the affected agencies."

In response to these policies, the applicants have consulted with NMFS, USFWS, and CDFW in regards to unavoidable impacts to threatened, endangered and native species and their critical habitat, and Essential Fish Habitat due to the mining activity and have incorporated their recommendations into their proposed mitigation plans. In order to compensate for impacts to longfin smelt and salmonids while mining in Central Bay, the applicants have each purchased 0.017 acres. [107] of freshwater habitat mitigation credits at Liberty Island Conservation Bank in Yolo County. The mitigation credits are located at a distance from the mining activity, however, it is the only mitigation bank available for fish impacts, and has been determined to be suitable compensatory habitat for salmonids by both CDFW and NOAA Fisheries. CDFW has also determined this bank is suitable for compensation for incidental take of longfin smelt.

[107] CDFW Incidental Take Permit, Amendment One 2014

These policies also offer opportunities to combine mitigation efforts and describe the framework necessary to allow flexibility in mitigation types in stating: “To encourage cost effective compensatory mitigation programs…the Commission may extend credit for certain fill removal and allow mitigation banking provided that any credit or resource bank is recognized pursuant to written agreement executed by the Commission.

…Mitigation banking should only be considered when no mitigation is practicable on or proximate to the project site.” The policies further define when fee based mitigation is a potential option. According to the applicants and the Resources Agencies, mitigation bank credit is the only current option for impacts to these species.

To address the impacts of sand mining to essential fish habitat (EFH) in Central Bay and Suisun Bay, Hanson Marine and Lind Marine together proposed as mitigation to contribute to CalRecycle’s Estuary Clean Up Project in an amount not to exceed $100,000 for all mining areas. The Clean Up Project clears debris (old pier pilings, abandoned ships) from the estuary in order to improve fish habitat. Hanson Marine will contribute by providing a portion of the funds. It is not clear at this time how the $100,000.00 worth of removal will be split between the two companies. CalRecycle will be responsible for the distribution of funds and the performance and completion of these projects.

In addition to mitigation policies, the Commission has several policies that encourage the expansion of scientific knowledge, especially where sufficient information is not currently available. Bay Plan policies on Subtidal Areas, Tidal Marshes and Tidal Flats, as well as dredging mirror the need for increased research and knowledge, as well additional studies of both habitat and impacts of proposed projects. Subtidal Areas Policy 5 states, in part that the Commission should continue to support and encourage expansion of scientific information on the Bay's subtidal areas, including: an inventory and description of the Bay's subtidal areas; the relationship between the Bay's physical regime and biological populations; sediment dynamics, including sand transport; … areas of the Bay used for spawning, birthing, nesting, resting, feeding, migration, among others, by fish, other aquatic organisms and wildlife…”Further, the Tidal Marsh and Tidal Flats policies state that the Commission should support comprehensive Bay sediment research and monitoring to understand sediment processes necessary to sustain and restore wetlands…” Lastly, Dredging Policy 12 states that the Commission should …continue to participate…other initiatives conducting research on Bay sediment movement, the effects of dredging…on Bay natural resources….”

In order to better understand the ecological environment that exists as well as the impacts of mining on the habitat, the applicants have agreed to conduct a benthic study of the Central Bay sandy deep water habitat as described previously in this document. It is anticipated the study would take between three to four years to complete. In addition, the applicants have proposed to continue the multibeam surveys and associated change analysis on a five-year basis to assist in ascertaining the changes to the Bay bathymetry as a result of mining activity. Staff has discussed additional potential

studies with the applicant to assist in assessing impacts to the San Francisco Bar and Ocean Beach (potentially tracer studies); an analysis of the volume of sand available to bedrock; and assistance in further refining the sand budget and transport into the lease areas an other sandy subtidal habitat. These discussions are ongoing.

The Commission should determine whether the reduced project volumes, the mitigation provided are sufficient given the identified potential impacts and whether the proposed studies are sufficient to support furthering the knowledge regarding this habitat and the mining activity.

5. **Dredging, Navigation Safety and Oil Spill Prevention.** San Francisco Bay Plan Dredging Policy 2 states that "[d]redging should be authorized when the Commission can find: (a) the applicant has demonstrated that the dredging is needed to serve a water-oriented use or other important public purpose, such as navigational safety; (b) the materials to be dredged meet the water quality requirements of the San Francisco Bay Regional Water Quality Control Board; (c) important fisheries and Bay natural resources would be protected through seasonal restrictions established by the California Department of Fish and Game, the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service, or through other appropriate measures; (d) the siting and design of the project will result in the minimum dredging volume necessary for the project…."

   In its application, Hanson Marine describes sand mining as a water-oriented use in that sand is mined from the Bay and serves the important public purpose of supplying sand to the construction industry from a local source, reducing greenhouse gas emissions, truck traffic, and impacts to Bay Area roadways. The applicant states that using sand from a local source allows for financial savings for public projects, and that obtaining aggregate from farther away increases its cost.

   As described above, the Water Board has issued a Water Quality Certification (WQC) and Waste Discharge Requirements (WDR). The WQC/WDR requires the applicant to comply with specific wastewater dilution ratios, mining of only non-hazardous materials, and does not allow discharge of pollutants or other materials that would cause nuisance or adversely affect beneficial uses, including increased turbidity and deleterious impacts to wildlife.

   Regarding seasonal work windows for this activity, the applicant has requested and received biological opinions and an incidental take permit from the Resource Agencies. In their review of the project, the Resource Agencies did not limit mining activity seasonally in Central Bay.

   In response to the question of whether the siting and design of the project would result in the minimum amount of dredging necessary for the project, the applicant has reduced the amount it proposes to dredge annually and the cap for the total amount dredged over a ten year period. The applicant has requested that it be authorized to exceed the annual limit when demand is high, as long as the total mined over ten years remains under 12.03 million cubic yards over ten years. This would allow them to address market fluctuations. In addition, the applicant states the proposed volume would be mined only if the market demanded such a volume, therefore the applicant has stated that they are minimizing the amount of mining necessary for the project.

The Bay Plan's Navigational Safety and Oil Spill Prevention Policy 2 states that the Commission should ensure that marine facility projects are in compliance with oil spill contingency plan requirements of the Office of Spill Prevention and Response, the U.S. Coast Guard and other appropriate organizations. As owners and/or operators of marine vessels operating in regulated waters of the state and often adjacent to or within federal navigational channels, Hanson Marine is required to abide by maritime laws and best safety practices. Specific to their sand mining activities, Provision 10 of the WQC/WDR requires the applicant to maintain and implement a CDFW Office of Oil Spill Prevention and Response-approved plan that demonstrates that adequate measures are in place to prevent and respond to accidental release of hazardous materials. Additionally, the CDFW ITP requires as a mitigation measure that requires the sand miners to follow state and federal laws and regulations in regards to hazardous waste spills and clean up. The ITP also prohibits the storage and handling of hazardous wastes in the project area. These permits and their requirements are intended to insure the applicant would operate in accord with the required navigational safety and oil spill contingency plans.

The Commission should determine whether the project is consistent with its policies regarding Dredging and Navigation Safety and Oil Spill Prevention.

6. **Public Trust.** The Bay Plan policy on Public Trust states that "[w]hen the Commission takes any action affecting lands subject to the public trust, it should assure that the action is consistent with the public trust needs for the area…." The public trust is a common law doctrine that guarantees the right of the public to use the state's waterways for navigation, commerce, fisheries, boating, recreation, natural habitat protection, and to preserve lands in their natural state for protection of scenic and wildlife habitat values. Public trust uses of public lands are generally limited to water dependent or water related uses, with some exceptions for ancillary structures necessary for the water dependent uses. Further, because public trust lands are held in trust for all citizens of the state, they must be used to serve statewide, as opposed to purely local, public purposes.[108]

   The State Lands Commission is responsible for determining if a project proposed on submerged or other sovereign land is consistent with the public trust uses as described above and managing those lands for the public.[109] In its decision granting the leases for the sand mining activity that is now before BCDC, the State Lands Commission did not make specific written public trust findings. However, every lease issued by the State Lands Commission has to be determined to be in the best interests of the State pursuant to Public Resources Code section 6005. Additionally, all sovereign lands and resources managed by the State Lands Commission are subject to the common law Public Trust Doctrine, so all decisions made by the Commission include a public trust consideration, even if there are not formal findings.[110]

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[108] State Lands Commission Public Trust Policy: http://www.slc.ca.gov/About_The_CSLC/Public_Trust/Public_Trust_Doctrine.pdf

[109] Ibid.

[110] Pemberton, State Lands Commission, writ. comm 2015

The FEIR considered public trust resources in detail, though not explicitly referring to the public trust use. In addition, the State Lands Commission staff report regarding the Hanson Marine project stated, "[t]hese mitigation measures [listed in the 2012 FEIR], taken together, will ensure consistency with plans and policies specifying that sand mining operations be conducted in an environmentally sound manner, that agencies protect public trust resources, and that sand mining operations be carried out in a manner that minimizes interference with critical wildlife activities."[111]

In 2014, Bay Keeper challenged the State Lands Commission's finding that the project is consistent with the public trust. Upon review, the Superior Court of the City and County of San Francisco upheld the State Lands Commission's finding. Bay Keeper has appealed this decision to the First District Court of Appeal. The court has not yet heard the appeal.

In completing its independent evaluation of the project, the Commission must determine if the project is consistent with the public trust needs of San Francisco Bay. Public trust needs include the same categories as the uses. Mineral extraction from trust property is an accepted trust use in aid of commerce, much like fishing, which removes natural material from the environment. For Central San Francisco Bay mining areas, the project appears to be consistent with navigational use even though some of the lease areas are overlaid with a federal navigation channel on the western side of Alcatraz Island. Because this area is naturally deeper than the draft needed by the large ships traversing the Bay, the ships can maneuver around the barge and tug without causing a navigation hazard. Similarly, water borne commerce distinct from sand mining and recreational boating would not be inhibited or limited by the mining activity.

It is unclear whether the project is consistent with the public trust as it pertains to natural habitat protection and the preservation of lands in their natural state for protection of scenic and wildlife habitat value needs. As described above, when mining sand, there is likely to be habitat degradation and loss of potential forage species living within and on the sand. In addition, removal of sands in transport may reduce the amount of sand available for outer coast beaches, affecting both recreation and habitat needs. Unfortunately, the volume of sand in transport to the outer coast is not well understood at this time.

Regarding statewide purposes, according to the applicant, sand mined from the Bay is used in local construction projects, including residential, commercial and public buildings, as well as roadways. Public buildings, roads, and highways serve a statewide purpose.

The Commission should evaluate the public trust needs and determine whether the project is consistent with its Public Trust policy.

B. **Review Boards**

1. **Science Review Panel.** A science panel of distinguished experts in the fields of geology, engineering, oceanography, marine and benthic ecology convened to discuss the currently available science about the transport of sandy sediment throughout the Bay Area to the outer coast and sandy shoal habitats. This panel discussed a series of

[111] State Lands Commission October 2012 Staff Report Statement of Overriding Considerations

management questions proposed by Commission staff regarding the current state of sandy sediment resources in the Bay, replenishment of sand in areas of extraction during mining events, habitat and species impacts, whether disturbance from mining has more of an impact on the biological community recovery than naturally occurring disturbances in the system, and potential monitoring that could be used to enhance understanding of sandy sediment resources, the communities that inhabit them and the potential impacts of mining on the system. While the discussion was not conclusive, it informed this process and the management measures that could be incorporated into a final permit authorization. An abridged transcript can be found at http://www.bcdc.ca.gov/dredging/SandMiningSciPanAbridged.pdf

C. **Environmental Review.** The State Lands Commission reviewed the potential project impacts and certified the Final Environmental Impact Report in 2012. The FEIR was challenged in 2013, regarding these issues, and the Superior Court of the City and County of San Francisco upheld the State Lands Commission determination. The Court's decision is currently on appeal, at the First District Court of Appeal. The Commission's regulations require that the permitting process continue during a CEQA challenge. In the event that the courts invalidate the CEQA certification, the permit action would be revisited. A summary of that document is attached as Exhibit E.

D. **Relevant Portions of the McAteer-Petris Act**

1. Section 66605(d)
2. Section 66632
3. Section 66664.4

E. **Relevant Portions of the San Francisco Bay Plan**

1. *San Francisco Bay Plan* Policies on Fish, Other Aquatic Organisms, and Wildlife
2. *San Francisco Bay Plan* Policies on Water Quality
3. *San Francisco Bay Plan* Policies on Tidal Marsh and Tidal Flats
4. *San Francisco Bay Plan* Policies on Subtidal Areas
5. *San Francisco Bay Plan* Policies on Dredging
6. *San Francisco Bay Plan* Policies on Recreation, g. Beaches.
7. *San Francisco Bay Plan* Policies on Mitigation
8. *San Francisco Bay Plan* Policies on Public Trust
9. *San Francisco Bay Plan* Policies on Navigational Safety and Oil Spill Prevention

Exhibits

A. **Regional and Project Vicinity Map**

B. **Proposed Mining Areas**

C. **Sand Offloading Facility Map**

D. **Sand Samples from Lease Parcels**

E. **Environmental Impact Report Summary**